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POLLUTION OF RIVERS.

WHAT SHOULD BE THE EXTENT OF IMMEDIATE
LEGISLATION TO RESTRAIN THE POLLUTION
OF RIVERS ?

BY

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ON LEGISLATION

FOR THE

RESTRAINT OF RIVER POLLUTION.

AN apology for this Paper, if one be needed, is to be found under the head of "The Sanitary Laws" in this year's Report of the Council of this Association to the annual business Meeting of its members. The Report states that—

"The great question of the best means for the ultimate disposal of Sewage has remained in abeyance during the past year. Little or nothing has been done ; and the difficulties attending the best mode to be adopted, and the means to be provided for acquiring the necessary land for irrigation, filtration, or other means of deodorization and defecation remain untouched and unsolved."

This statement affords good reason for making some attempt at progress during the present session of the Association, and the moment appears not unfavourable to it. A public Meeting called by the Fisheries' Preservation Association, on the 11th June last, passed resolutions that an endeavour should be made to obtain legislation in restraint of the pollution of rivers, and the Prime Minister was asked to receive a deputation on the subject. Mr. Disraeli, owing to the pressure of business, was unable to grant a personal interview to the gentlemen deputed to communicate with him, but stated that—

"The several resolutions passed at the Meeting shall receive his most attentive consideration, more especially as the subject is one in which he takes much interest."

I shall now, therefore, proceed to state my views on the extent to which legislation on this subject should be carried, and explain my reasons for holding them, in the hope that the Society for Promoting the Amendment of the Law, which is united with this Association, may give their attention to the question, and strengthen the hands of the Fisheries' Preservation Association in their good work.

Whilst fully persuaded that, in inland towns at least, irrigation or filtration through large masses of earth will prove to be the most satisfactory means that can be adopted for the ultimate purification of Sewage, I entertain a strong conviction that it would be a serious error, in the present condition of the question, to force its adoption universally; and indeed I doubt whether it should be made compulsory in any case until greater experience of its effects than we at present possess has been gained. So long as there is a possibility of the House of Commons upsetting, as in the Birmingham case, well-devised measures for irrigation, on the representation of the injury that might be inflicted on landowners, the country cannot be looked upon as being ripe for insisting upon the complete purification of Sewage water. The strong advocacy of irrigation which we have witnessed during recent years has, indeed, proved a serious obstacle to progress. A wide jump has been attempted where stepping-stones would have afforded a safer and shorter mode of surmounting the difficulty. This view of the question is advocated in an article in the "Engineer," on 29th July last, on the proceedings of a deputation from Kingston-on-Thames, Surbiton, and Hampton Wick:—

"The deputation remarked that 'irrigation had been recommended,' but owing to the difficulty of obtaining land they could not carry out such a project satisfactorily. Some reason shows itself in this argument. . . . The Commissioners proposed irrigation. Theoretically, they were right; but practically, the world was little the better for their advice. . . . Where will the towns find their land? How has Birmingham fared in this matter, and what has been the conduct of Parliament? . . . But what do these gentlemen mean when they say that 'owing to the difficulty of procuring land they could not obtain effluent water of the standard required by the Thames Conservancy.' It would rather appear to us that there is some mistake here. Setting aside the question of utilising the Sewage, there is surely some possibility of defecating it. If the so-called 'standard' of the Thames Conservators cannot be reached, is that a reason why absolutely raw Sewage should flow into the river day by day? If the towns were really to set to work and do something, the probability is that they would obtain an effluent water which would immensely benefit the stream. The Sewage question is thrown back by this bogus of a 'standard.' Towns are doing nothing because they cannot convert the foul liquid of their sewers into a crystal stream so pure in its character that it will probably excel the stream into which it flows. There are

means and appliances by which Sewage can be shorn of all its positively repulsive features, and all the effect of Royal Commissions and Acts of Parliament seems to amount to this—That we are not to do what we can, but are to contemplate that which we cannot do.”

It is not, however, correct to assume that Royal Commissions have proposed irrigation to the exclusion of all other modes of dealing with Sewage. There is undoubtedly “a mistake here,” into which local authorities are only too prone to fall when an excuse is wanted for doing nothing. The early Reports of the Royal Commissioners to inquire into the best mode of distributing the Sewage of Towns point out clearly what may be reasonably expected to be done, without reference to irrigation, for the amelioration of the condition of rivers; and state the grounds on which they make their recommendations.

“The chief part of the nuisance arising from the discharge of Sewage into rivers and streams may be obviated by simply arresting the solid matter in suspension in the liquid, for that by far the greater part of the solid matter which is held in suspension in water is readily deposited in rivers, covering the banks with mud, permanently raising the beds, gradually destroying the scouring power of water, and partially silting such rivers up; and that in some instances these deposits have accumulated to such an extent as to impede navigation, to render the surrounding country subject to floods, and to entail a vast expense in periodic cleansing. That however the appearance of the water may be improved after these deposits have taken place, yet the deposited matters lying in the bed of the current are under conditions favourable for putrefaction, and when the foul mud is disturbed by the prevalence of rain and during floods, it sends forth its effluvia amidst the populations which are near, and even in the course of the rivers far distant.”

“This condition of rivers,” they say, “has been a public and national nuisance; it interferes with the convenience and comfort of all classes of the people; it damages various and important interests, as those connected with manufacturing establishments, canals, fisheries, and so on; it deteriorates property to a large extent, and as interfering with a main source of water supply, is of serious importance to the public health.”

If “the chief part” of such evils as these is to “be obviated by arresting merely the solid matter in suspension in the liquid,” why should so simple an expedient have been so long neglected? Is it not, indeed, intolerable that local authorities should for the last sixteen years, with this Report before them, have persisted that they are at a loss how to make any improvement?

Nor is this all the information Royal Commissions have given us on this point. The Report dated 26th March, 1858 (and signed amongst other authorities by a distinguished Vice-President of the Health Section of this Association, Mr. Rawlinson), also explains in what manner the solids may be most cheaply, easily and inoffensively removed.

“The use of lime to separate the solid matters of Sewage is founded on the following circumstances:—Sewage of itself, from the slimy glutinous character of the matter floating in it, and from the specific weight of that matter being so nearly the same with water, will only separate very imperfectly, and after a length of time, into a clear liquid and a solid deposit. The addition of lime, however, by the chemical changes which it induces, but which we need not here describe, causes a separation of the solid suspended matter in a state of flocculence, in the same way that white of egg clears coffee or isinglass fines beer. The result is that the Sewage rapidly changes its character, separating readily into a deposit which falls to the bottom, and a clear liquid.

“Without going so far as to say that the precipitation by Lime is a perfect success, or that it can in all cases be adopted, we feel satisfied that it does to a great extent fulfil the purpose for which it is employed, so far, at least, as the purification of rivers is concerned.

“By far the largest amount of nuisance and danger arising from the pollution of rivers by Sewage is due to the solid suspended matters, which give off noxious effluvia throughout the period of their decomposition. This is especially the case in our tidal rivers, where these deposits form shoals and cover the banks, and at low water offer a vast surface of offensive matter for the contamination of the air. The Lime process does effectually remove this solid suspended matter, and in so far accomplishes a great and manifest good. It also destroys the immediate influence of the noxious gases of Sewage, and although it may in the abstract be open to the objection of still leaving matter capable of further putrefaction in the liquid, we are of opinion that wherever this liquid is thrown into a body of water considerably larger than itself, no evil results will practically be experienced.

“Our conclusion, then, is that in the absence of the means for the direct application of Sewage to land, the methods of precipitation at command do actually offer remedial measures of a very satisfactory character.”

It is no uncommon thing for local authorities, whilst admitting that they could remove the solids from their Sewage, to throw

the blame of their inaction on the difficulty of deciding between the various promising schemes suggested for disposing of the matters extracted; but the Report already quoted declares that none of them are promising in the sense aimed at, viz., commercial advantage:—

“We may at once state our belief, that as far as present knowledge goes, this very simple process offers as much prospect of commercial advantage in respect to the manufacture of a solid manure from Sewage as any patent process that has been proposed.

“But with reference to the prospect of obtaining any very large profit from the treatment of Sewage, we see no reason to dissent from the view that has been individually held and promulgated by several of our members, that neither the Lime process nor any other existing method of precipitating Sewage is likely to be commercially advantageous to those who engage in it. We consider that this is, however, not the light in which the matter should be viewed. The great problem is to get rid of Sewage, advantageously to agriculture if it may be; if not, at the least expense to the community at large.

“Throughout the discussions that have hitherto occurred upon this question, the real issue has been left comparatively in abeyance. The primary consideration is not whether the Sewage can be made serviceable to agriculture, but whether or not there exists any method which, consistently with a fair expenditure of money, falling on those who ought in justice to bear it, will practically rid us of the nuisance and danger attendant upon town Sewage.”

They conclude their Report thus:—

“We have already stated our belief that, unless some new process of greater efficiency should be discovered, the formation of a solid manure from Sewage will not be remunerative; that is to say, that the amount realized by the sale of the manure will fall short of the cost of its production. Neither is this to be considered as a condition dependent on want of appreciation of the manure, which time and better information on the part of the consumer will remove; on the contrary, the tendency has been hitherto to put the price above the value which a sound acquaintance with the nature of manures would attach to it. It is even questionable whether, in some instances, any money at all would be given for this deposit, and in considering the practicability of carrying into effect plans for the precipitation of Sewage we must be prepared for this eventuality.”

The accuracy of these statements has been corroborated by the later Reports of the Rivers Pollution Commissioners, by the

leading agricultural chemists of the day, and by actual experience. To delay action until a saleable manure can be made out of ordinary Sewage deposit is, in fact, to postpone indefinitely the cleansing of our rivers, and if there be truth in the following observations by the Royal Commission on Distributing the Sewage of Towns, the valueless nature of the product affords no valid grounds for remaining inactive:—

“Expedients for the purpose of depriving the Sewage of its offensive and noxious properties have been brought into practical operation, and have been attended with more or less success.” “The more this subject has been investigated the more convincing is the evidence that there is no town which might not, with reasonable care and at moderate cost, greatly mitigate the existing evils, where it may not be practicable wholly to remove them.”

With such evidence before us, it is absurd to assert that local authorities are without guidance, and to argue that, because they cannot be sure whether this or that would prove the more economical method of dealing with their Sewage, they should be allowed to sit with their arms folded, and wait for something to turn up to relieve them of the cost of doing what they ought to set about at once. A Mayor in the West of England lately published a pamphlet in which, referring to the difficulty of disposing of Sewage sludge, he naively says: “I would urge the policy of waiting *for a little longer* (the italics are the worthy Mayor’s); *at all events, for the result of experiments which others are making.*” It is, however, but fair to state that the Mayor wished to commence at once to “disinfect and deodorize” the Sewage, though he does not explain the mode in which he would accomplish these objects.

But it is often argued that the remedy will be worse than the disease; that the nuisance created by deposits from Sewage will lead to injunctions against poisoning the air, and that on the whole it will be safer to continue to poison the rivers. There is, however, sufficient evidence to show that these fears are groundless. The Commission on the Distribution of the Sewage of Towns arrived at the following conclusion upon this point, viz. :—

“That, considered merely as the means of mitigating a nuisance, these precipitating processes are satisfactory; that the cost of them

in any case is such as town populations may reasonably be called upon to meet; that the necessary works need not, if properly conducted, be a source of nuisance; and that by modifications of the existing methods even the slightest risk of nuisance may be entirely obviated."

This was written in 1858. In 1872, in the Parliamentary inquiry on the Birmingham Sewerage Bill, Dr. Frankland, one of the Rivers Pollution Commissioners, is asked:—

"Would there be any nuisance caused by the depositing process and the use of chemicals?"

And he replied:—

"I should apprehend no nuisance whatever if lime were employed. . . . The lime deposit and the sludge collected from the Sewage of Ealing, although I had a quantity thrown upon the ground before me, was absolutely inodorous."

Again, at the same inquiry, Dr. Voelcker is asked:—

"Do you think they (the suspended matters) may be removed in a form that they may be made into cement or dried manure without causing a nuisance there?"

He replied:—

"I know that it can be done, and it has been done at Ealing."

Moreover, further and complete proof of this can now be obtained by any one who will take the trouble to visit Birmingham, where considerable quantities of sludge are being continually dried in the open air without annoyance to anybody. Before the Lime process was used the results, it is true, were very different. The sludge then proved to be what Mr. Hawksley called "a very abominable thing;" it caused such a nuisance that Dr. Letheby "could hardly endure the smell;" and Mr. Hope said, "It stinks worse than anything I ever smelt out of Constantinople."

Except, therefore, in small country places, it would manifestly be advisable that provision should be made not only for compelling the removal of the solids from Sewage, but for their

deodorization by lime, or some other equally efficacious means.

In considering whether legislation should be carried further than to make it imperative to remove the solids from Sewage water, it must not be forgotten that the use of precipitants secures the triple advantage of complete precipitation of the suspended matters, the more or less complete deodorization of the deposit and the liquid effluent, and the removal from the liquid of more than one-half of the dissolved nitrogen, which is its most offensive element. The Rivers Pollution Commissioners found by trial, at Leicester and Stroud, that precipitation produced the following diminution of the highly putrescible nitrogenous ingredient in the Sewage of those places:—

PERCENTAGE OF ORGANIC NITROGEN REMOVED.

Lime Process.	A B C Process.	Sulphate of Alumina, with filtration through charcoal.
60.13	54.46	52.0

The case then in favour of compelling towns to remove the solids from Sewage before casting it into rivers is very strong, and the reasons for deodorizing it by precipitation with chemicals are weighty; but if it can be shown that these processes are the best and, indeed, a necessary preliminary to irrigation and cleansing by earth filtration (to which all those who have studied the subject with unbiassed mind look as offering the most hopeful and final solution of the Sewage question), the argument for legislation to this extent will be irresistible.

The eminent Sewage farmer, Mr. Hope, says:—

“It is because, in my judgment, Sewage irrigation cannot be carried out from the utilization point of view without storage tanks, that it becomes necessary to deal in some way with the sludge, because if you store you cannot avoid deposition. I am prepared to go further, and say that as irrigation with Sewage containing the whole of the sludge causes much more smell than irrigation with Sewage out of which the whole or a portion of the sludge has been taken, there are many situations where the extraction of the sludge ought to be compulsory, simply because in a country thickly studded with villas and country houses, I do not think that any man has a right to offend the noses of his neighbours.”

Again, in reply to questions put to him at the Birmingham Sewerage Bill enquiry, Mr. Hope gave the following evidence:—

“Do you provide for the exclusion of the ordinary excreta? * * * I altogether approve of taking the sediment from the Sewage. * * *

“But with regard to the Sewage of Birmingham, on the whole it is really neither one thing nor the other? (That is, ‘not irrigation and not wholly filtration.’)—I think it is very much the same as every other Sewage scheme must be. As to the solid matter, it must be taken out.

“You see that you thought of the enormous strain (upon the purifying power of the land) at that time? (11th September, 1871.)—Yes.

“* * * At that time, at any rate, you thought that, as a matter of course, a few years would produce an excess of organic matter in the filter?—I should be of the same opinion now, if it was proposed to run sludge on to the surface of the land.

“What do you mean by sludge?—Sewage sludge.”

Dr. Letheby, at the same enquiry, stated that—

“Sewage run upon land without being previously defecated by chemicals will be a nuisance wherever it is put on.”

And being asked—

“May I take it, therefore, that you lay it down before the Committee that the proper way of dealing with the Sewage would be, in the first place, some chemical process of defecation to separate the suspended matter and some portion of the matters in solution, and then use the land as a filter for further purifying the Sewage?”

the reply was—

“I believe that is the right thing to do.”

Mr. Hawksley, questioned on the same point, replied thus:—

“Now, my friend will ask, if I do not, whether you will venture to say that that process can be carried on over this land without any nuisance?—I am certain of it; if you kept off the untreated sludge, which is very offensive.

“You have said that Sewage, when it is poured upon the land without any preparation of this kind, does make a great nuisance. You have often said that?—Yes; the nuisance varies in degree, according to the state of the weather—the comparative amount of water with which the Sewage becomes mixed. * * *

“* * * If they ask me what in the abstract I think the right

thing, I tell them decidedly that a method of precipitation, or a mixed system of precipitation and filtering, would answer the purpose."

One of the chief objections which have been made to Sewage irrigation from the sanitary point of view has been the enormous area of land which would be required to purify the Sewage of our large towns; on this account, if for no other, it would appear, from Mr. Hope's evidence just given, that previous removal of the suspended matters is desirable; and the same opinion is held by other eminent authorities.

The Rivers Pollution Commissioners say, in their fourth Report:—

"We demonstrated in our Report on Pollution arising from the woollen manufacture (1871) vol. i., p. 33, that very foul waste liquors from woollen dye works can be efficiently purified by intermittent filtration through earth, at the rate of about one gallon per cubic yard of earth per 24 hours. But this is a very slow rate of filtration; and we expressed a hope that it might be considerably accelerated by mixing the liquor with a small quantity of slaked lime before allowing it to flow upon the filters. This anticipation has been realized; and we have been able, as the following analytical results show, to purify approximately six times as much of the limed as of the unlimed liquor per cubic yard of earth."

Dr. Frankland gave evidence before the Birmingham Sewerage Select Committee to the effect that much less land would be required if the Sewage was previously chemically treated, and Dr. Odling, examined on this point, made answer thus:—

"Would the precipitation in those tanks allow the water to flow on in the remaining portion of the conduit to a great extent clarified and purified?—Yes; it would be both clarified and (in the sense of no longer smelling) purified.

"In your opinion would any nuisance arise from taking the water so clarified on to the land?—Certainly not.

"If your view is correct, and these experiments are correct, why is it to deposit at all; it ought all to go on to the land, ought it not?—No, certainly not; we are talking of passing liquid containing organic matter through land. If, in addition to that, it contains a large amount of suspended matter, which will deposit upon the land, you will require a very much larger area of land. I should say that it would be quite impossible to do with this area of land if you put the Sewage fresh upon it, and allowed the suspended matter, which

is intended to deposit in the tanks at Dunton, to deposit upon the surface of the land.

“It is only by taking out previously a certain amount of nastiness in the shape of sludge, and getting it to deposit, that you can do it at all?—It is only in that way that you can do it on such an area as this unoffensively.”

But the strongest evidence in favor of preliminary precipitation was given by Dr. Voelcker, the most practised of living chemical agriculturists. He states:—

“The chemical precipitation of the sedimentary matter, which is of very little agricultural value, removes the impediment in the application of Sewage to the land, which is so great that many farmers, who I have no doubt would use the clarified liquid, will not use the raw liquid on account of the sedimentary matter which forms a deposit, choking up the pores of the soil, and therefore in a great measure neutralizing the fertilizing effects which the substances in solution would otherwise produce.”

Here then we have the greatest authorities on the subject (agriculturists, chemists, medical men and engineers) all concurring in recommending as a preliminary to the ultimate and complete purification by land the very processes which Royal Commissions have declared to “offer remedial measures of a very satisfactory character.” What possible objections, then, can town authorities have to offer to the adoption of a precipitation plan, or at all events of a subsidence system, excepting those suggested by fear of increasing the rates? The argument that they do not know the degree of purification which may hereafter be required of them has little weight when it is seen that some method of removing the solids, which cannot be accomplished without depositing tanks, is the first thing to be accomplished in any case. And the Government might, without any fear of having to retrace its steps or modify its decisions, confidently make a stand here and enact that, excepting in heavy thunder storms, *no Sewage shall be cast into any river or stream if it contains in suspension more than a certain amount of matter per gallon.* Might it not safely go so far as to adopt the decision of the Parliamentary Committee on the Birmingham Sewerage Bill, and enact that, in the vicinity of dwellings, *“no Sewage be put upon any land without having been previously defecated in tanks?”*

This would compel the adoption of either precipitation or irrigation and earth filtration, or both, and the stumbling-block

of a standard which cannot always be attained will be done away with. It should be borne in mind, too, that though irrigation is, when well carried out, a complete remedy, perfect management cannot always be secured in practice. In such cases of failure the previous precipitation proves an important safeguard. Sewage farmers, even with severe penalties before their eyes, will certainly turn the Sewage into the nearest brook when their land is in danger of being water-logged in wet weather. They will run the risk of detection and possible penalty rather than encounter a certain evil in the loss of their crops. And even if farmers could be relied on to do their duty, other causes of failure intervene. We read in the Reports of the Rivers Pollution Commissioners that, at Banbury, "The soil tends to crack in dry weather, thus giving the Sewage direct access to underground drains, and thence to the river, before it has been properly acted upon by the soil." They found that, at Norwood, the "removal" (in the month of January) of offensive nitrogenous organic matter was partially arrested, "and indicating that during a severe winter the purification of Sewage upon a non-absorptive clay soil may be seriously interfered with." They found, also, "exceptionally impure water" from the Norwood farm at other periods of the year, and at Croydon, as at Norwood, during frost the purification "became markedly impaired."

Now, to provide against such cases preliminary clarification would be a valuable adjunct, and for the reasons given it might, as I believe, be enforced, without hardship, in all cases in which purification of Sewage by irrigation would be liable to create a nuisance, as well as in cases where irrigation is not adopted.

To insist on more than this, considering the extent to which the Government is itself implicated in the production of the evils which have accompanied the water carriage system, would certainly be impolitic and perhaps unjust. A high standard of purity can only be attained, in the present state of our knowledge at least, by irrigation or some modification of it, and suitable land for the purpose cannot always be attained, or can only be obtained and utilised at a ruinous cost. Moreover, any legislation which aims at too much will merely prove a dead letter. The experience of Birmingham shows how little the public mind is prepared for a comprehensive scheme to be carried out on land purchased by compulsion.

In this case almost every man of eminence who could throw any light on the subject was consulted. A singular unanimity prevailed amongst the advisers as to the course which should be

adopted. The plans proposed commended themselves to every unbiassed man who made himself acquainted with the evidence. A Parliamentary Committee patiently investigated all that could be said upon the question, and approved the Bill. If the House of Commons had had the same opportunity of forming an opinion as their Committee they would probably have concurred in the decision, but an unwillingness to interfere with existing rights prevailed, and the best Sewage Bill ever prepared was thrown out. The country is, in fact, not prepared for compulsory irrigation, even if carried out with all the precautions which science and experience can suggest.

This contest cost Birmingham some £15,000, but it will probably save the town from the heavy expenditure which the success of their Bill would have entailed. It has afforded also an undeniable proof that large towns can clarify their Sewage and get rid of the deposit without a nuisance and without entailing a heavier expense than they can reasonably be called upon to bear. The Law Courts have appreciated the earnest attempts which the town has made to get rid of the nuisances caused by its Sewage, and no longer rigorously press the injunctions brought against them. That which Birmingham would have done if it had been permitted to carry out its scheme could not be accomplished by all towns; that which Birmingham has fallen back upon is a first step towards a more perfect compliance with sanitary requirements, and might fairly be exacted in every case in which the outfall communicates with a river or stream.

In bringing this subject before the Association I have for obvious reasons made use, as far as possible, of the Reports of the Royal Commissions upon it. It is to be presumed the different Governments which appointed them had some intention of carrying out their recommendations, and such recommendations are entitled to the best consideration of the Ministers now in office. It is to be presumed, also, that these Reports are in the hands of all those really seeking information and guidance; and it is well that special attention should be drawn to the passages I have quoted. Municipal authorities will therein find:—

1st. That “a great and manifest good” will be effected, and “the chief part of the nuisance arising from the discharge of Sewage into rivers and streams may be obviated by simply arresting the solid matter in suspension in the liquid.”

2nd. That in the removal of the solids “even the slightest risk of nuisance may be entirely obviated,” and the condition of

the effluent much improved, by the adoption of a process of precipitation.

3rd. That these objects can be secured "consistently with a fair expenditure of money falling on those who ought in justice to bear it," and at a cost "such as town populations may reasonably be called upon to meet."

4th. That towns which are intending to resort to irrigation and intermittent downward filtration will, by the adoption of a precipitating process, purify the Sewage on a much smaller area. And when to these considerations is added the following:—

5th. "That Sewage utilization cannot be carried out from the utilization point of view without storage tanks," and that the liquid is, in the generality of cases, preferred by the farmer when freed from solids and slimy compounds—it becomes difficult for towns to show just cause why they should not be peremptorily and at once restrained from the further contamination of rivers by the sedimentary matters of Sewage.

In conclusion, let me ask this question:—Since the simple measures recommended by the Royal Commissioners will "greatly mitigate the existing evils"—(I use their own words)—"practically rid us of the danger and nuisance of town Sewage," may we not reasonably hope that a Ministry which has promised Sanitary legislation will listen to an urgent appeal to have these measures enforced? There would be no necessity that legislation should altogether stop at this point. When all the offending towns in the country have been compelled to comply with a low standard of purity, a higher one may be attempted with some chance of success. To insist upon absolute, or nearly perfect, purity now would end in leaving matters as they are.



